REMARKS

Claims 16 and 18-25 are pending in the application. Claims 16 and 18-25 are rejected. Claims 26-30 have been added. Claims 16 and 18-30 remain in the case for reconsideration. Reconsideration is requested. No new subject matter has been added.

Claims 16 and 29

Claims 16 and 18-22 are rejected under 35 USC 103(a) as being unpatentable over Shiau (US Patent No. 5,880,857) in view of Mintzer (US Patent No. 5,210,602).

Claim 16 has been amended to specify: generating a set of multiple random seed values from a random number generator independently of any image information associated with the array of pixels and any pixel values for initializing the error buffers and for use as initial error values when starting an error diffusion operation including generating random seed values associated with a first set of the array of pixels to be printed for a digital image; and

initializing the error buffers associated with the array of pixels with the set of adjusted random seed values that were generated independently of any image information associated with the array of pixels prior to starting the error diffusion operation for reducing startup transients during the error diffusion operation including initializing a first set of the error buffers associated with the first set of the array of pixels to be printed for the digital image with adjusted random seed values that were generated independently of any image information and prior to the starting of the error diffusion operation.

This is clearly show in the present application in FIG. 3 where all the seed values are generated prior to the start of error diffusion independently of the image information and further described in the specification starting at page 6 where the seed values X_1, X_2, and X_3 are generated independently of any image information. Further, FIG. 2 and page 6, lines 6-12 explain how a first set of error buffers associated with the first pixel values to be printed, starting with pixel value 22, are initialized with adjusted random seed values independently of any image information.

Conversely, combining Shiau with Mintzer teaches away the initialization specified in claim 16. For example, the noise generator 5 in Shiau generates random numbers according to image data having a multiple-level grey signal. See FIGS. 2-10 and column 2, lines 19-30 in Shiau. Thus, Shiau does not generate seed values independently from the image data as

specified in claims 16 and 29. In addition, Mintzer in FIG. 3 and at column 7, lines 30-42 describes multiplying constants from a "constant store" by random numbers and puts the results into the "coefficient store", not into an error store as specified in claim 16.

Combining Shiau with Mintzer also teaches away from claim 16 because the combination results in generating seed values according to the associated image data (see gray levels in FIGS. 2-10 in Shiau used to generate the random numbers). Further, a first set of error buffers in Shiau cannot be loaded with adjusted seed values prior to any diffusion process because error diffusion is performed for each pixel at the same time the random number is generated by noise generator 5. See FIGS. 2 and 3 where the error values are output from comparator 1 according to the random numbers generated from noise generator 5. Further, refer to column 3, lines 59-62 in Shiau that states that random noise is added to the error diffusion modified video or image signal.

Thus, it would be impossible in Shiau to load a first set of adjusted seed values into error buffers prior to the diffusion process, since the values generated from noise generator 5 in Shiau are used to perform the error diffusion process. Column 3, lines 59-62.

Claims 18 and 28

The Examiner states that Shiau discloses adjusting each of the random seed values from the random number generator (figure 17 and column 5, lines 40-49) such that the adjusted random seed values associated with the array of pixel are relatively large, likely to cause a dot to be printed, and increase the likelihood that dots will be printed sooner when a transition occurs between a zero image region and a nonzero image region (figure 17; and column 5, lines 15-19 and lines 50-54).

The Examiner explains that the random noise generator in Shiau generates a random number between negative 255 and positive 255 (column 5 lines 15-19). The Examiner then states that for gray values, particularly gray values near the peaks of the noise amplitude distribution (figure 17), multiplied by the generated random number (column 5, lines 50-54) will be relatively large, likely to cause a dot to be printed, and increase the likelihood that dots will be printed sooner when a transition occurs between a zero image region and a nonzero image region.

To further clarify the invention, claim 28 states:

"The method according to claim 16 including loading the random seed values in the error buffers by selecting only the random seed values with relatively large values such that all of the adjusted random seed values associated with the array of pixels have relatively large values compared with the other random seed value and initializing the error buffers associated with the array of pixels only with the set of adjusted relatively large random seed values."

This is clearly described in the specification at page 5 starting at line 7 that states:

"If the initial values of the error buffer are made to be larger than typical seed values, dots are more likely to be produced sooner when a transition occurs between a zero image region and a nonzero image region. This reduces the impact of the error diffusion process's startup transient on output image quality.

In addition, if the error values in the buffer are generated as random numbers, any periodic patterns will be mitigated or avoided. Therefore, for a single-color grayscale system, application of the invention will include generating a set of random numbers and controlling the selection of the numbers to be relatively large prior to loading the numbers in the error buffer for initialization."

Shiau tries to address disruption of periodicity of any objectionable patterns but does not address the problem with periodicity as it relates to large uniform light areas that may occur in the first areas of a printed page.

Shiau does not "adjust each of the random seed values from the random number generator prior to loading the random seed values in the error buffers by selecting only the random seed values with relatively large values such that all of the adjusted random seed values associated with the array of pixels have a relatively large value, likely to cause a dot to be printed and increase the likelihood that dots will be printed sooner when a transition occurs between a zero image region and a nonzero image region" as specified in claim 28 (emphasis added).

Shiau at column 5, lines 15-18 states: "In the preferred embodiment, the random number generated by the random noise generator 11 is uniformly distributed between plus or minus 255..."

The random values generated in Shiau by the random number generator are not then adjusted by selecting only the random numbers with relatively large values. As clearly explained and shown in figure 6 of Shiau, the random noise generator produces a ± random noise number.

(see the "± NOISE" output from Random Noise Generator 11 in FIG. 6). Further, this random ± random noise number is then multiplied by values X from the noise look-up table 13 to generate a ± X*NOISE (see the output of multiplier 15 in FIG. 6).

Shiau at column 5, line 50 confirms that the coefficient from the look-up table is fed to the multiplier 15 which multiplies the coefficient and the noise signal generated by the random noise generator 11. The product of this multiplication is the actual random noise signal fed to the adder 3 shown in FIGS. 2 and 3.

The result are noise values that as shown in FIG. 6 are completely random and are not adjusted as specified in claim 28. For example, some of the values in Shiau would be negative, and when summed with a pixel value would decrease the likelihood that a dot would be generated. In other words, some of the values will create <u>smaller</u> seed value that are <u>less</u> likely to cause a dot to be printed and <u>decrease</u> the likelihood that dots will be printed sooner when a transition occurs between a zero image region and a nonzero image region. These positive or negative numbers would nullify one of the purposes of the present invention by actually nullifying the effects of any larger random seed values. Thus, Shiau would not prevent problems with periodic patterns becoming noticeable with a large uniform light area in the first areas to be printed.

The present invention as specified in claims 18 and 28 select only relatively large random seed values so that <u>all of the set of pixels</u> are more likely to print dots in initial white areas of a page.

There simply is no suggestion in Shiau, Mintzer, Levien, or any of the other cited art, of adjusting each of the random seed values from the random number generator prior to loading the random seed values in the error buffers by selecting only the random seed values with relatively large values such that all of the adjusted random seed values associated with the array of pixels have a relatively large value, likely to cause a dot to be printed and increase the likelihood that dots will be printed sooner when a transition occurs between a zero image region and a nonzero image region.

Accordingly, claim 28 is allowable under 35 USC 103(a) over Shiau (US Patent No. 5,880,857) in view of Mintzer (US Patent No. 5,210,602). Independent claim 18 also includes a similar limitation:

"adjusting each of the random sets of seed values for each of the first, second and third color planes such that all of the random seed values are relatively large to increase the likelihood that dots will be printed sooner when a transition occurs between a zero image region and a nonzero image region"

Thus, claim 18 is allowable for the same reasons as claim 16.

Independent Claim 24

Claim 24 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Shiau in view of Mintzer. The Examiner states that Shiau discloses generating two numbers from a random number generator (column 3, lines 62-66) generating a first distribution variable from the two numbers (FIG. 17 and column 5, lines 40-49); generating a first set of seed values from the first distribution variable for use as initial error values for starting up an error diffusion process; and initializing the error values with the first set of selected seed values prior to starting the error diffusion operation.

However, the Examiner acknowledges that Shiau does not disclose:
a first normally distributed variable from the two numbers; generating a second normally distributed variable from the two numbers that is negatively correlated with the first normally distributed variable; generating a second set of seed values for using as initial error values for starting up the error diffusion process from the second normally distributed variable; generating a third normally distributed variable from the two numbers that is negatively correlated with the first normally distributed variable and the second normally distributed variable; generating a third set of seed values for using as initial error values for starting up the error diffusion process from the third normally distributed variable; and initializing is performed with respect to the first, second, and third set of seed values prior to starting the error diffusion operation.

The rejection is respectfully traversed. However, to further clarify the invention, claim 24 has been amended to clarify generating two independently generated random numbers from a random number generator. This is clearly described in the specification at page 6, lines 29-32.

Shiau does not disclose generating two independent random numbers from a random number generator at column 3, lines 62-66 and does not disclose generating a first distribution variable from the two numbers at FIG. 17 and column 5, lines 40-49. Conversely, Shiau at column 3, lines 62-66 describes a random noise generator 5 in FIG. 2 that produces a single

random noise signal with is added to the error diffusion modified image signal by adder 3. Shiau does not even suggest generating seed values for three different color planes. There are not two independently generated random numbers generated by the random noise generator 5 in FIG. 2 of Shiau or in Mintzer, Levien or any of the other prior art that are used for:

generating a first normally distributed variable from the two numbers; generating a first set of seed values from the first normally distributed variable for use as initial error values for starting up an error diffusion process; generating a second normally distributed variable from the two numbers that is negatively correlated with the first normally distributed variable; generating a second set of seed values for using as initial error values for starting up the error diffusion process from the second normally distributed variable; generating a third normally distributed variable from the two numbers that is negatively correlated with the first normally distributed variable and the second normally distributed variable; generating a third set of seed values for using as initial error values for starting up the error diffusion process from the third normally distributed variable; and initializing the error buffers with the first, second, and third set of seed values prior to starting the error diffusion operation as specified in claim 24.

The technique of using multiple random variables to generate multiple sets of seed values that are all 120 degrees out of phase is also not described in Mintzer. Mintzer does even suggest generating seed values from multiple independently generated random numbers as specified in claim 24. Therefore, it would not be obvious for someone with average skill in the art to make these seed values 120 degrees out of phase, since there is no suggestion in any of the cited prior art to even generate three sets of seed values from two random numbers.

The values referred to in Mintzer are not error diffusion seed values as specified in the present claims. Claim 24 explicitly specifies using the seed values as initial error values for use in starting up an error diffusion process. Claim 24 also does not specify balancing the seed values out to zero. The choice of 120 degree separation in the seed vector generation trig calculations promotes the negative correlation of the three treated channels (e.g., C, M, and K). This increases the chance of dot-off-dot output among the three treated channels and is not the same as balancing the seed values out to zero as suggested by the Examiner.

It is not obvious to generate randomly generated seed values and then adjust the seed values to be out of phase. The very nature of random values is that they are random and not associated with any particular pixel data. Thus, generating random error diffusion seed values

and adjusting the values to be 120 degrees out of phase with other random error diffusion seed values associated with other color planes provides an unexpected result of reducing certain error diffusion artifacts that would still exist in the digital half-toning systems described in the prior art.

The fact that Mintzer describes three sets of seed values and Shiau only contemplates modifying a single gray scale to compensate shows that it is not obvious to generate three sets of seed values that are each 120 degrees out of phase. If it were obvious, or necessary, it would have been suggested in Mintzer or Shiau.

Accordingly, claim 24 is allowable under 35 USC 103(a) over Shiau in view of Mintzer and Levien.

Conclusion

No new matter has been added by this amendment. Allowance of all claims is requested. The Examiner is encouraged to telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.

Customer No. 46404

Respectfully submitted,

MARGER JOHNSON & McCOLLOM, P.C.

Stephen S. Ford
Reg. No. 35,139

MARGER JOHNSON & McCollom
210 SW Morrison St., Suite 400
Portland, OR 97204
(503) 222-3613